



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/635,510	08/07/2003	Hiroshi Kawashima	241264US6	8472
22850	7590	04/21/2005	EXAMINER	
OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314			RUGGLES, JOHN S	
			ART UNIT	PAPER NUMBER

1756

DATE MAILED: 04/21/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/635,510

Applicant(s)

KAWASHIMA ET AL.

Examiner

John Ruggles

Art Unit

1756

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 07 August 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-9 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-9 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 07 August 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 8/7/03.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Information Disclosure Statement***

The information disclosure statement (IDS) submitted on 8/7/03 has been considered by the examiner, except for the Japanese document 10-326010 due to a lack of English translation thereof. However, it is noted that this document corresponds to US Patent 6,137,901, which has been considered.

### ***Drawings***

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because in Figure 11 reference characters "MS12", "MS13", and "MS23" have each been used to designate two different and separately positioned sub-mesh regions.

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because Figure 11 does not include the following reference sign(s) mentioned in the corresponding description thereof at page 15 line 12: "MS21", "MS31", and "MS32".

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Art Unit: 1756

For the purpose of this Office action and in order to advance the prosecution of this application, Figure 11 and the corresponding description thereof in the specification are interpreted to mean that the bottom row center sub-mesh region labeled "MS12" should have been --MS21--, the bottom right-hand corner sub-mesh region labeled "MS13" should have been --MS31--, and the right column center sub-mesh region "MS23" should have been --MS32--.

### *Specification*

35 U.S.C. 112, first paragraph, requires the specification to be written in "full, clear, concise, and exact terms." The specification is replete with terms, which are not clear, concise and exact. The specification should be revised carefully in order to comply with 35 U.S.C. 112, first paragraph. Examples of some unclear, inexact or verbose terms used in the specification are: (1) at page 2 line 1, "plurality of photomask is" should be changed to --plurality of photomasks are--; (2) at page 3 lines 3-6, the sentence describing the first correction in step (a) seems unclear, so it is suggested that the phrase "a space between the mask pattern and an adjacent mask pattern thereto and a desired configuration" be changed (to e.g., --(i) a space between the mask pattern and another mask pattern adjacent thereto and (ii) a desired configuration--; etc.); (3) at page 5 line 20, "description will be made on the occupation rate R of" should be changed to --description will be given of the occupation rate R for--; (4) at page 10 lines 11 and 14, "process **or the like**" (emphasis added) is unclear; and (5) at page 14 lines 20-21, it is unclear whether this passage is referring to the "fourth" or "third" preferred embodiment. Note that due to the number of errors, those listed here are merely examples of the corrections needed and do not represent an exhaustive list thereof.

Appropriate correction is required. An amendment filed making all appropriate corrections must be accompanied by a statement that the amendment contains no new matter and also by a brief description specifically pointing out which portion of the original specification provides support for each of these corrections.

***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 8-9 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contain subject matter, which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The specific calculation or formula for the “average” occupation rate of each mesh region M along with those other mesh regions adjacent thereto has not been found in the specification to the extent needed. It is uncertain whether or not Applicants intend to include only those mesh regions that are immediately adjacent and against the mesh region in question to determine the “average” occupation rate of the mesh region in question (e.g., using 4 total mesh regions for the average occupation rate of a corner mesh region, using 9 total mesh regions for the average occupation rate of a center mesh region, etc.). For the purpose of this Office action and in order to advance the prosecution of this application, claims 8-9 have been construed broadly to include the use of any “average” occupation rate calculated over plural mesh regions.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

Claims 1-9 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 1 step (a) drawn to making a first correction for correcting a configuration of a mask pattern, the phrase “in accordance with a space between the mask pattern and an adjacent mask pattern thereto and a desired configuration” is unclear with regard to whether this first correction is either (1) --in accordance with (i) a space between the mask pattern and another mask pattern adjacent thereto and (ii) a desired configuration-- or (2) --in accordance with a space between the mask pattern, another mask pattern adjacent thereto, and a desired configuration--. For the purpose of this Office action and in order to advance the prosecution of this application, the above phrase in claim 1 step (a) has been interpreted in accordance with (1) above. Claims 2-9 depend on claim 1.

In claim 6, the phrase “size by which said photomask is divided into said plurality of regions is **changed** by a correction factor” (emphasis added) is unclear with regard to whether or not the size of regions was actually changed from a first size to a second different size for dividing the photomask into a plurality of mesh regions. However, for the purpose of this Office action and in order to advance the prosecution of this application, this phrase has been interpreted to mean --size by which said photomask is divided into said plurality of regions is selected by a correction factor--, in accordance with page 11 line 25 to page 12 line 1 of the

Art Unit: 1756

specification (which states, in part, "size to be selected for a mesh region M for each correction factor"). Claim 7 depends on claim 6.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Harazaki (US Patent 6,137,901) in view of Inoue (US Patent Application Publication US 2002/0142233) and further in view of Takahashi (US Patent 5,948,573).

Harazaki teaches a method of correcting pattern layout for a photomask or mask that combines both (1) an optical proximity correction (OPC) in an imaged resist (which is well known in the art of mask design and layout for counteracting pattern shape deformation in accordance with close spacing between pattern shapes) and (2) an additional correction of pattern deformation in an imaged resist due to pattern density (column 12 lines 1-11). A correction table (e.g., adjusted by simulations, etc., instant claim 4) is used to make needed pattern corrections (column 2 lines 40-53, as shown by blocks S45-S47 in the Figure 13 flowchart). The size of individual mesh regions (e.g., squares, etc.) into which the overall pattern is divided for correction of pattern layout is taught as having an area no larger than  $(k\lambda/4NA)^2$  and preferably substantially equal to this formula (or function) to avoid unnecessary calculation steps, where k is a process constant (e.g., usually 0.4 to 1.0, etc.),  $\lambda$  is the exposure wavelength, and NA is the

Art Unit: 1756

numerical aperture of the exposure apparatus (column 12 lines 39-54, instant claim 6). This method of correcting the mask pattern layout is accurate and fast (column 3 lines 26-30).

While teaching a correction that involves dividing the mask into a plurality of mesh regions and performing correction due to pattern density, Harazaki does not specifically teach that: *[1]* the pattern density correction is based on an occupation rate, which is the relative area occupied by the opaque pattern in each separate mesh region of the divided overall mask pattern (instant claim 1); *[2]* the correction in accordance with the spacing between adjacent mask patterns (OPC) has a smaller range effect than that in accordance with the occupation rate based on an area ratio (instant claim 2); *[3]* both corrections are made independently for each of plural correction factors (instant claims 3 and 7); *[4]* correction is based on a correction function (instant claim 5); and *[5]* correction is based on an average of occupation rates (instant claims 8-9).

Inoue teaches a process of making a photomask or mask that involves corrections to pattern layout based on calculated (1) pattern area ratio "C" (e.g., area of light shielding/opaque regions, etc. to the total area of the mask pattern) and (2) pattern density "D" (e.g., portion of light shielding/opaque regions, etc. within the overall area of the mask pattern, abstract, instant claim 1 for correction in accordance with an occupation rate based on an area ratio *[1]*). These calculations are derived into a correlation function "f" (Figure 2, instant claim 5 for a correction function *[4]*). A plurality of process conditions are employed to make the mask and a separate (independent) correlation or correction function "f" is obtained for each process condition (paragraph [0045], instant claims 3 and 7 *[3]*), which is used to obtain a function  $r = F(C, D)$  giving an amount of change "r" for mask layout data [0047]. Alternatively, average pattern



Art Unit: 1756

density for a peripheral region within a specified distance (e.g., within 100 microns, etc.) from an extracted pattern is used for pattern density, with the size of the peripheral region set at 100 microns (but is not limited to this size [0099], instant claims 8-9 [5]). Resulting advantages include both high yield and high stability while still obtaining the desired positional accuracy in the mask manufacturing process [0074, 0091, 0101].

Takahashi teaches a method of designing a mask using average relative pattern area ratios or occupation rates in meshes (mesh regions as subdivisions of the overall mask pattern, abstract, column 3 lines 10-23). The overall mask pattern is divided into 100  $\mu\text{m}$  x 100  $\mu\text{m}$  meshes (Example 1, column 14 lines 32-33). Average pattern area ratios or occupation rates are determined by equations (1-1) and (1-2) (column 14 lines 33-64). Averaging of pattern area ratios or occupation rates is necessary to allow reduction of the great fluctuations in pattern area ratios or occupation rates for individual pattern meshes (column 15 lines 8-13, instant claim 2 [2]).

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the teachings of Inoue [1, 3-5] and Takahashi [2] with those of Harazaki, because all three references relate to the same art of correcting the layout or design of mask or photomask patterns. Resulting advantages include both high yield and high stability while still obtaining the desired positional accuracy in the mask manufacturing process, as taught by Inoue. Takahashi's emphasis on correcting for *great* fluctuations in occupation rates or pattern area ratios for individual mesh regions in the overall mask pattern suggests a greater concern about compensating for a wider range of corrections in accordance with the occupation rate than those in accordance with the spacing between adjacent mask patterns (e.g., OPC, etc. [2]).

Art Unit: 1756

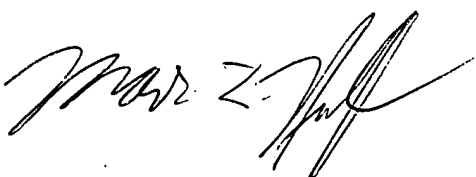
***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Iwasaki (US Patent Application Publication 2003/0096177) teaches relationships between transistor gate widths and spaces (e.g., see paragraphs [0028, 0031], etc.).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John Ruggles whose telephone number is 571-272-1390. The examiner can normally be reached on Monday-Thursday and alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



**MARK F. HUFF  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 1700**



**John Ruggles  
Examiner  
Art Unit 1756**